(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0208 Roll No. | | | | | | | | | | |

B. Tech

(SEMESTER-III) THEORY EXAMINATION, 2012-13

BASIC SYSTEM ANALYSIS

Time : 3 Hours] *[Total Marks : 100*

Note : Attempt **all** questions.

Section – A

1. Answer **all** parts of this section : **2 × 10 = 20**

   (a) Define Z-transform and write its properties.

   (b) What do you mean by "continuous + ive signals" ?

   (c) Write "FINAL VALUE THEOREM" in Laplace Transform domain.

   (d) What do you understand by "STATE TRANSITION MATRIX" ? Also mention its properties.

   (e) State "INVERSE LAPLACE TRANSFORM".

   (f) Enlist f-i analogy of a given mechanical systems.

   (g) What do you understand by "FIRST" and "SECOND" order systems ?

   (h) What do you mean by solution of difference equations in Z-transform domain ?

   (i) Define "STATE" and "STATE VARIABLES" in state space representations.

   (j) What are the properties by FOURIER INTEGRALS ?

Section – B

2. Answer any **three** parts of the following : **3 × 10 = 30**

   (a) What do you mean by "ANALOG" and "DIGITAL" signals ? Also mention its advantages and disadvantages. Give their physical examples.

(b) Derive the Laplace transform of the waveform as shown in fig. 1.

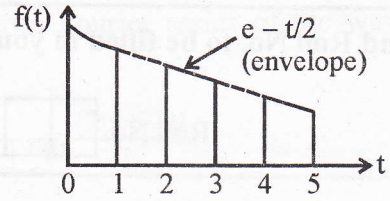

Fig. – 1 Waveform

(c) For the given Laplace transform

$$Y(s) = \frac{17s^3 + 7s^2 + s + 6}{s^5 + 3s^4 + 5s^3 + 4s^2 + 2s}$$

Find the initial and final value of the corresponding five function y(t).

(d) Determine the Fourier transforms and amplitude spectrums of the following functions :

(i) $f(t) = \exp(-a|\, t\, |)$ for all values of t.

(ii) $f(t) = 1, -\infty < t < \infty$

(iii) Unit impulse function, $\delta(t)$.

(iv) Unit signum function, $Sgn(t) = -1, t < 0$

$= 1, t > 0$

(e) Draw the electric analogy, by f-υ and f-I analogy, of the mechanical system shown in fig. 2. Write the equilibrium equations of the mechanical system.

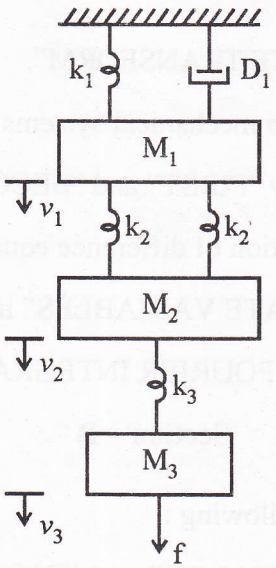

Fig. – 2 Mechanical System

Section – C

Answer all questions : $5 \times 10 = 50$

3. What do you mean by "FOURIER TRANSFORM" and "INVERSE FOURIER TRANSFORM" ? Also mention its advantages and disadvantages.

OR

What do you understand by "LAPLACE TRANSFORM" ? Also mention its advantages and disadvantages. Enlist any five applications of Laplace transforms.

4. Explain the following :

(i) ELECTRO-MECHANICAL SYSTEMS

(ii) PERIODIC SIGNALS

OR

Find $L^{-1}[F_1(s) \cdot F_2(s)]$ by using convolution integral theorem for the following functions :

(i) $F_1 = \frac{1}{s(s+1)}$; $F_2 = \frac{1}{(s+3)}$

(ii) $F_1 = \frac{1}{(s+a)}$; $F_2 = \frac{1}{(s+b)(s+c)}$

5. The natural response of a certain system is described by the homogeneous state equations :

$$\frac{dy_1}{dt} + 7y_1 - y_2 = 0, \text{ and}$$

$$\frac{dy_2}{dt} + 12y_1 = 0$$

Determine the state transition matrix of system.

OR

Consider the system described by

$$\ddot{y} + 3\dot{y} + 2y = u$$

Derive the state space representation. Choose the state variables such that the system matrix becomes diagonal.

6. The unit step response of a system is given by $(1 - e^{-bt})$. Determine the unit impulse and unit ramp response h(t) of the system.

OR

Show that trigonometric Fourier series of the wave form as shown in fig. 3 can be written as :

$$f(t) = \frac{1}{2} + \frac{6}{\pi} \sum_{p=0}^{\infty} \frac{1}{2p+1} \sin \frac{(2p+1)t}{L}$$

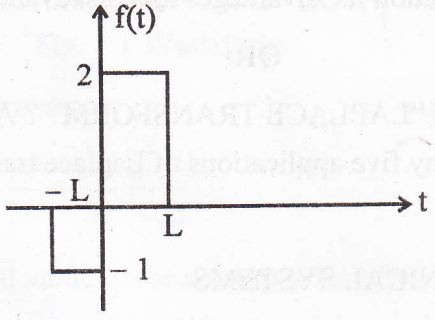

Fig. – 3 Waveform

7. A series R-L-C circuit with R = 5Ω, L = 5 mH; C = 50 μf has an applied voltage V(t) = 150 sin 1000 t + 100 sin 200 t + 75 sin 3000 t. Determine the effective current and average power.

OR

Calculate the impedance, resistance, power and power factor of a circuit whose expression for voltage and current are given by :

$\upsilon = 100 \sin (wt + 60°) - 50 \sin (3wt - 30°)$ volts

$i = 10 \sin (wt + 60°) + 5 \cos (3wt + 60°)$ amps